We claim:

1. A process for partially oxidizing propene to acrylic acid in the gas phase under heterogeneous catalysis by conducting a starting reaction gas mixture 1 comprising propene, molecular oxygen and at least one inert gas in a first reaction stage over a fixed catalyst bed 1 whose active composition is at least one multimetal oxide comprising the elements Mo, Fe and Bi, in such a way that

-the fixed catalyst bed 1 is arranged in two spatially successive temperature zones A, B,

-both the temperature of temperature zone A and the temperature of temperature zone B are a temperature in the range from 290 to 380°C,

-the fixed catalyst bed 1 consists of at least two spatially successive fixed catalyst bed zones, and the volume-specific activity within one fixed catalyst bed zone is substantially constant and increases sharply in the flow direction of the reaction gas mixture 1 at the transition from one fixed catalyst bed zone to another fixed catalyst bed zone,

-the temperature zone A extends up to a conversion of the propene of from 40 to 80 mol%,

-on single pass of the starting reaction gas mixture 1 through the entire fixed catalyst bed 1, the propene conversion is ≥90 mol% and the selectivity of acrolein formation and also of acrylic acid by-production taken together and based on converted propene are ≥90 mol%,

-the sequence in time in which the reaction gas mixture 1 flows through the temperature zones A, B corresponds to the alphabetic sequence of the temperature zones A, B,

-the hourly space velocity of the propene contained in the starting reaction gas mixture 1 on the fixed catalyst bed 1 is ≥90 l (STP) of propene/l of fixed bed catalyst 1·h

-the difference $T^{maxA} - T^{maxB}$, formed from the highest temperature T^{maxA} which the reaction gas mixture 1 has within temperature zone A, and the highest temperature T^{maxB} which the reaction gas mixture 1 has within temperature zone B is ≥0°C,

optionally reducing the temperature of the product gas mixture leaving the first reaction stage by cooling and optionally adding molecular oxygen and/or inert gas to the product gas mixture, and afterward conducting the product gas mixture as a starting reaction gas mixture 2 which comprises acrolein, molecular oxygen and at least one inert gas, and contains the molecular oxygen and the acrolein in a molar $O_2:C_3H_4O$ ratio of ≥0.5 in a second reaction stage over a fixed catalyst bed 2 whose active composition is at least one multimetal oxide comprising the elements Mo and V, in such a way that

-the fixed catalyst bed 2 is arranged in two spatially successive temperature zones C,D,

-both the temperature of temperature zone C and the temperature of temperature zone D are a temperature in the range from 230 to 320°C,

-the fixed catalyst bed 2 consists of at least two spatially successive fixed catalyst bed zones, and the volume-specific activity within one fixed catalyst bed zone is substantially constant and increases sharply in the flow direction of the reaction gas mixture 2 at the transition from one fixed catalyst bed zone to another fixed catalyst bed zone,

-the temperature zone C extends up to a conversion of the acrolein of from 45 to 85 mol%,

-on single pass of the starting reaction gas mixture 2 through the entire fixed catalyst bed, the acrolein conversion is ≥ 90 mol% and the selectivity of acrylic acid formation, based on propene converted over both reaction stages, is ≥ 80 mol%,

-the sequence in time in which the reaction gas mixture flows through the temperature zones C, D corresponds to the alphabetic sequence of the temperature zones C, D,

-the hourly space velocity of the acrolein contained in the starting reaction gas mixture 2 on the fixed catalyst bed 2 is ≥70 l (STP) of acrolein/l of fixed bed catalyst 2·h

-the difference $T^{maxC} - T^{maxD}$, formed from the highest temperature T^{maxC} which the reaction gas mixture has within temperature zone C, and the highest temperature T^{maxD} which the reaction gas mixture has within temperature zone D is ≥0°C,

wherein neither the transition from temperature zone A to temperature zone B in fixed catalyst bed 1 nor the transition from temperature zone C to temperature zone D in fixed catalyst bed 2 coincides with a transition from one fixed catalyst bed zone to another fixed catalyst bed zone.

2. The process as claimed in claim 1, wherein $T^{maxA} - T^{maxB}$ is ≥3°C and ≤ 70°C.

3. The process as claimed in claim 1, wherein $T^{maxC} - T^{maxD}$ is ≥3°C and ≤ 60°C.

4. The process as claimed in claim 1, wherein the propene hourly space velocity on the fixed catalyst bed 1 is ≥90 l (STP)/l·h and < 160 l (STP)/l·h.

5. The process as claimed in claim 1, wherein the propene hourly space velocity on the fixed catalyst bed 1 is ≥160 l (STP)/l·h and ≤ 300 l (STP)/l·h.

6. The process as claimed in claim 1, wherein the chemical composition of the active composition used is unchanged over the entire fixed catalyst bed 1.

7. The process as claimed in claim 1, wherein the entire fixed catalyst bed 1 comprises not more than 4 fixed catalyst bed zones.

8. The process as claimed in claim 1, wherein, when the active composition is uniform over the entire fixed catalyst bed 1, the volume-specific active composition in the fixed catalyst bed 1 in the flow direction of the reaction gas mixture 1 increases by at least 5% by weight at the transition from one fixed catalyst bed zone to another fixed catalyst bed zone.

9. The process as claimed in claim 1, wherein, when the active composition is uniform over the entire fixed catalyst bed 1, the difference in the volume-specific active composition between the fixed catalyst bed zone in the fixed catalyst bed 1 having the lowest volume-specific activity and the fixed catalyst bed zone in the fixed catalyst bed 1 having the highest volume-specific activity is not more than 40% by weight.

10. The process as claimed in claim 1, wherein the last fixed catalyst bed zone of the fixed catalyst bed 1 in the flow direction of the reaction gas mixture 1 is undiluted and consists only of shaped catalyst bodies.

11. The process as claimed in claim 1, wherein the fixed catalyst bed zone having the highest volume-specific activity within the fixed catalyst bed 1 does not extend into temperature zone A.

12. The process as claimed in claim 1, wherein there is no transition from one fixed catalyst bed zone to another fixed catalyst bed zone in the fixed catalyst bed 1 within the range of $X^1 \pm L^1 \frac{4}{100}$ where L^1 is the length of the fixed catalyst bed 1 and X^1 is the point within the fixed catalyst bed 1 of transition from temperature zone A to temperature zone B.

13. The process as claimed in claim 1, wherein the chemical composition of the active composition used is unchanged over the entire fixed catalyst bed 2.

14. The process as claimed in claim 1, wherein the entire fixed catalyst bed 2 comprises not more than 4 fixed catalyst bed zones.

15. The process as claimed in claim 1, wherein, when the active composition is uniform over the entire fixed catalyst bed 2, the volume-specific active composition within the fixed catalyst bed 2 in the flow direction of the reaction gas mixture increases by at least 5% by weight at the transition from one fixed catalyst bed zone to another fixed catalyst bed zone.

16. The process as claimed in claim 1, wherein, when the active composition is uniform over the entire fixed catalyst bed 2, the difference in the volume-specific active composition between the fixed catalyst bed zone within the fixed catalyst bed 2 having the lowest volume-specific activity and the fixed catalyst bed zone within the fixed catalyst bed 2 having the highest volume-specific activity is not more than 40% by weight.

17. The process as claimed in claim 1, wherein the last fixed catalyst bed zone in the flow direction of the reaction gas mixture is undiluted and consists only of shaped catalyst bodies.

18. The process as claimed in claim 1, wherein the fixed catalyst bed zone having the highest volume-specific activity does not extend into temperature zone C.

19. The process as claimed in claim 1, wherein there is no transition from one fixed catalyst bed zone to another fixed catalyst bed zone in the fixed catalyst bed 2 within the range of $X^2 \pm L^2 \frac{4}{100}$ where L^2 is the length of the fixed catalyst bed 2 and X^2 is the point within the fixed catalyst bed of transition from temperature zone C to temperature zone D.